



PV POWER

Newsletter of the IEA Photovoltaic Power Systems Programme



SEPTEMBER
2000

Contents

- P.2 PHOTOVOLTAICS FOR THE BUILT ENVIRONMENT
- P.3 NATIONAL BUY-BACK RATE FOR GERMANY
- P.4 PV MICRO-GRID HELPS REVITALISE RURAL SPAIN
- P.5 TRAINING ACCREDITATION
- P.6 IN BRIEF
- P.7 PVPS NEWS
- P.8 WHEN GRID POWER IS NOT AN OPTION...
- P.8 RENEWABLE ENERGY PROJECT ANALYSIS SOFTWARE

The Swiss-designed 'Solarsail' captured public imagination as an exhibit in the PVPS Task VII BIPV Design competition. See pages 2-3.

PHOTOVOLTAICS FOR THE BUILT ENVIRONMENT

The results of PVPS Task VII's international design competition for PV products for the built environment were announced in May. Prizes totaling 7 000 Euros were awarded to five winners in 4 product categories.

Task VII's objectives are strongly oriented towards enhancing the architectural and technical quality of PV systems specifically for use in urban settings. The design competition aimed to encourage attractive, innovative and functional approaches for integrating PV into these environments with products for which there is a clearly identifiable market. The competition entries were assessed primarily on how well they addressed these key criteria, with additional marks being awarded for ease of installation, operation and maintenance, efficiency of performance, practicality and cost-effectiveness of manufacture, design flexibility and regard to environmental considerations.

More than 60 architects, engineers, designers and students registered for the competition. These were narrowed down to 29 entries from 10 countries, with designs grouped into four categories: roofing prod-

ucts, façades, other building products (such as shading devices and building entrances), and PV products recently released into the market.

The overall competition winner, together with the designs judged to be best in each category were announced during the 16th European PV Solar Energy Conference in Glasgow.

Robert Webb of Robert Webb Associates, UK, won EUR 1 500 as the overall competition winner for his design for PV panels as a ventilated rainscreen system over a lightweight stressed-skin timber construction. The judges admired the overall concept for the building and its consideration for environmental and passive solar issues in addition to electricity generation.

Andrew Weight from Reading University, UK, was the winner of the roofing products category, as well as overall student winner. He was awarded EUR 1 500 for his PhotoFIT design. This design for mounting PV modules to provide a roof or façade covering used an innovative profile system as the module frame. It aims to minimize costs by simplifying installation requirements in terms of components, complexity and time.

The judges considered it to be a well-presented and well thought through entry, giving good consideration to the integration of cabling and avoiding the problem of the frame shadowing the module.

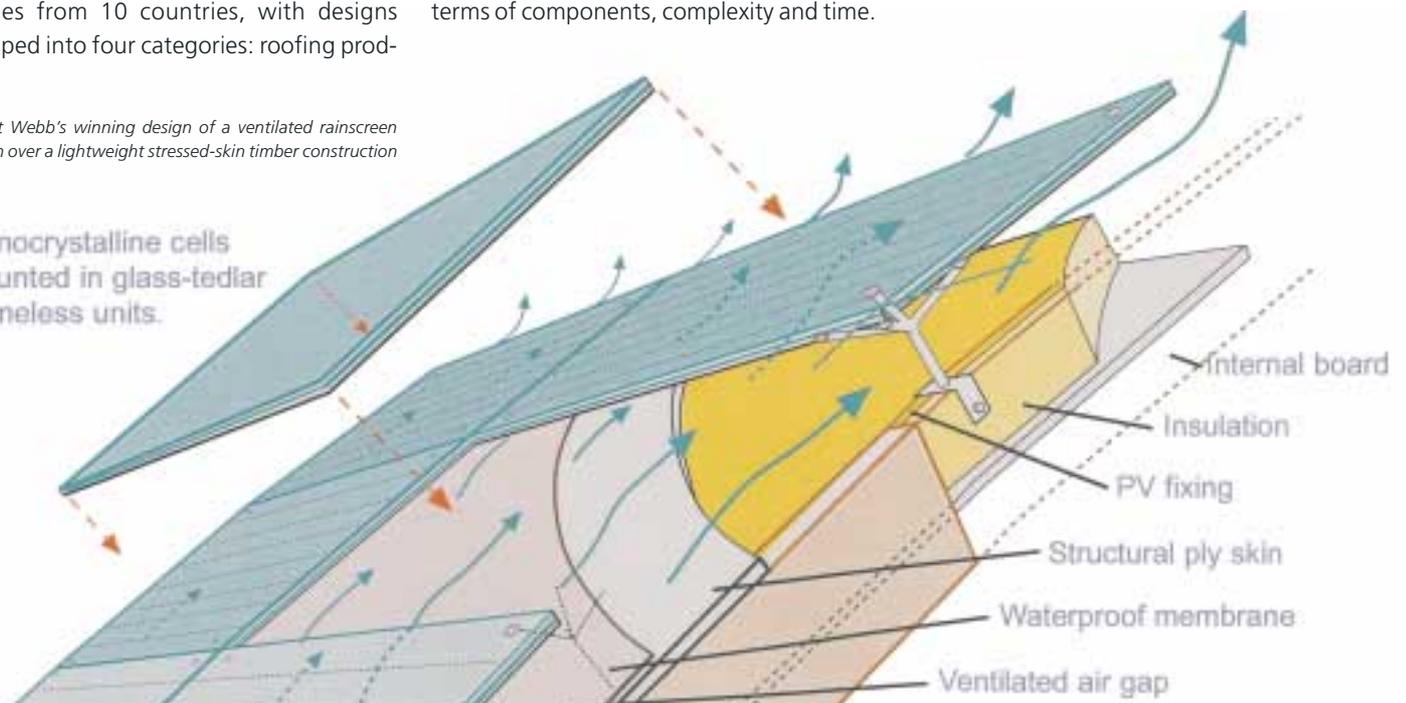
The façades category prize of EUR 1 500 was shared between Marcel Ferrier, an architect from Switzerland and a team of three students (S Tomatsuri, K Kondo and T Ohashi) from Hosei University, Japan. Marcel's design was for a PV façade on a circular building that addressed the issue of the sun's movement in an innovative manner. The Japanese design was for a building with a PV roof and façade with water flowing over the module surfaces. The combination of PV and water-cooling systems aims to keep the building and PV installation cool.

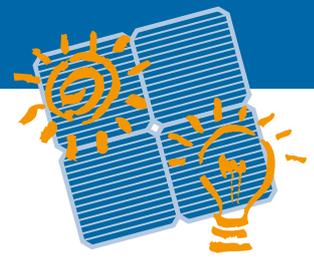
A practical and sturdy design for a PV Sunshade system that both optimized solar gain and avoided self-shading won EUR 1 500 for the other building products category. D Hewitt and R Braunstein of Kawneer Co. in the USA submitted the design.

The recently released products short listed were all roofing products, and included sys-

Robert Webb's winning design of a ventilated rainscreen system over a lightweight stressed-skin timber construction

monocrystalline cells
mounted in glass-tylar
frameless units.





tems to fit onto sloped roofs, PV roof tile systems and systems for mounting PV modules on flat roofs. They were all well developed designs providing cost effective and practical methods of mounting PV on a wide range of roof types. A team from Econergy International in the Netherlands was the category winner with their INTERSOLE design that allows a range of module types and sizes to be integrated into any type of tiled roof in a weatherproof manner. The judges commented that this was a practical system likely to be good value for money.

In addition to the main category prizes, an

award of EUR 1 000 was presented to Halle 58 Architekten, in Switzerland for their



PhotoFIT - simple componentry to keep installation time and costs to a minimum

Solarsail creation. This prize was awarded on the basis of the number of votes given to the entry by visitors to the exhibition of short listed designs held at the Glasgow conference. All the short listed entries were exhibited at the conference and visitors to the exhibition were invited to vote on their favourite design.

For further information, visit Task VII on the PVPS Website, <http://www.iea-pvps.org>, or download the official final judges report from the Task VII website, <http://www.task7.org>.

Alternatively, contact Angela McKenna at Halcrow, Fax: +44 (0)1793 815020

IEA

NATIONAL BUY-BACK RATE FOR GERMANY

As of 1 April 2000, a nationwide buy-back tariff of 0,99 DEM/kWh for PV generated electricity has been available in Germany.

The new rates form part of the Renewable Energy Law (REL) which has established buy-back terms for electric power generation from all renewables. The broad objective of the law is to double the contribution of renewables to Germany's power mix from 5% in 1999 to 10% in 2010, and to contribute towards bringing the cost of renewable generation in line with that of conventional methods in the medium to longer term.

For PV the new buy-back rate can be combined with favourable loans available under the 100 000 roofs programme. This stimulated unprecedented interest – and considerable disarray – in the rooftop programme in the run-up to the launch of the REL. Nearly 10 500 applications to the pro-

gramme were submitted during March – some 6 500 more than during the whole of 1999. This was largely due to the widespread understanding that the ten year zero-interest loan available under the rooftop scheme was to be replaced with somewhat less favourable terms, in order to ensure that the programme remained within budget.

The programme was temporarily halted shortly after the REL launch to prevent further applications being made until the new loan conditions were defined. The rooftop initiative is now in operation again with revised installation targets and modified low-interest loan conditions in place. Whereas the original programme was scheduled for six years (1999-2004), the added benefit of the REL buy-back rate means that the same PV installation target of 300 MWP now seems likely to be achieved by the end of 2003.

Under the REL, acceptance of renewably-

generated electricity is obligatory for the local distributors and transmission grid operators. The scheme is funded through a small premium added to the general electricity tariff (equivalent to 0,001 DEM/kWh) payable by every electricity purchaser throughout the country. As of 2002, the buy-back rate payable for new installations will be reduced by 5 % per year in order to encourage cost-convergence with conventional generating technologies.

Contact: Peter Sprau, WIP
Fax: +49 (0)89 720 1291



PV MICRO-GRID HELPS REVITALISE RURAL SPAIN

The village of San Felices is located at an altitude of 700 m in Aragón, the Spanish Pyrenees. The lack of infrastructure in the region caused a progressive depopulation of such villages during the 20th Century, but rural development projects like the one described below are supporting their revitalisation.

The project utilises a stand-alone PV power plant comprising a 10 kWp array, 180 kWh battery bank and power conditioner (charge regulator and inverter) to generate AC electricity which is distributed via a micro-grid. The system was designed for 15 connections but initially provides energy for 6 houses, a community hall, a church, a hostel/museum and public lighting. Centralizing the PV plant requires fewer modules and batteries than if each house is supplied by an independent PV system. In addition, only one power conditioning unit is needed to supply all the houses which simplifies maintenance.

The 90 m² array of 135 x BP 275 (75 Wp) modules is integrated into the roof of a purpose-built building in a way that takes into account the natural and architectural surroundings. The building contains the power conditioning equipment (2 x TapS C-

8648 units providing 12 000 Wp MPP-tracking regulator and 7,5 kW inverter), 180 kWh Powerbloc battery storage (providing 7 days autonomy) and a back-up propane gas generator for emergencies. It also houses a community hall.

System reliability is enhanced by the Power Conditioning Rack, which controls all aspects of operation. This unit includes the charge regulator as well as converting direct to alternating current of mains quality (230 V - 50 Hz). Operational performance parameters (state of charge, battery voltage, PV-current etc.) are recorded hourly. Key meteorological data are also registered. These data can be seen in real time on the unit's display, or analysed remotely via modem-link. This facilitates early failure detection and timely maintenance.

The energy service delivered is equivalent to that of the public grid, though attention to load management is more critical. Each house is fitted with an energy-dispenser and meter which limits the amount of energy available for each user in accordance with their predetermined needs and the contracted tariff. The service scheme is managed by SEBA (Servicios Energeticos Basicos Autonomous), which also provides social and technical support for the end users.

Installation of the micro-grid enabled other infrastructure facilities to be introduced to the village at the same time. Pipes for drinking water and waste water were installed in the ditches used to bury the electric cables. In a second phase, water purification and waste water treatment will be completed. The total cost of the PV plant, distribution, public lighting and water distribution system was just under EUR 221 000 (approx. USD 204 000), co-financed by the European Commission, National, Regional and local governments and the users themselves.

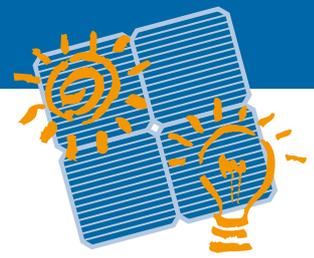
This installation was undertaken as part of SEBA's 'Programa de Energetización Renovable Autónoma (PAERA)', which is now providing energy service to 36 isolated sites in the provinces of Huesca and Zaragoza. SEBA, a non-profit users group founded in 1989, has promoted nearly 250 PV installations in rural Spain to date. Together with the Fraunhofer Institute for Solar Energy Systems (ISE), Germany, and The Spanish engineering firm Trama TecnoAmbiental, SEBA has recently produced a brochure about Successful User Schemes for Photovoltaic Stand-Alone Systems, which can be downloaded from ISE website: <http://www.ise.fhg.de/english/projects/pv-standalone/index.html>

For further information contact Xavier Vallvé, Trama TecnoAmbiental
Fax: +34 93 456 6948



User involvement throughout the installation process – from conception to delivery – is invaluable for ensuring the system meets local needs in the most appropriate way.





TRAINING ACCREDITATION

Since 1996, the non-profit Institute for Sustainable Power, Inc. (ISP), has been working with the PV industry, the finance community, standards and certification professionals, and the education and training community to develop and implement an international PV training accreditation and practitioner certification framework.

Funding organizations and government agencies are very interested in market development of sustainable technologies, but often the infrastructure needed to successfully market, install, and service the technical solutions that they wish to support is inadequate. Training is one component needed for successful market development, and the ISP and its partners are working to define the tasks, knowledge, and skills needed for the successful implementation of dispersed sustainable energy technology. The outcome of this work is a series of certificates for PV professionals (e.g. installation and maintenance practitioners) based on minimum knowledge and skills competency standards, which will provide customers, financial professionals, and employers with an objective indication of professional competency.

ISP is one of four organisations working with The World Bank to develop a series of implementation manuals to address infrastructure needs: Installation and Maintenance Practitioner Certification (ISP); Quality Manufacturing (PV GAP); Testing Laboratories Quality Systems (Florida Solar Energy Centre); and, Quality Component Design (ECN).

The ISP has developed a manual for implementation of a training accreditation and practitioner certification programme at the country level. The project is being piloted in India, Sri Lanka, and China, and supported in South Africa.

The initial pilot of these four infrastructure components was held in Jaipur, India, in



October 1999. ISP organised a five-day workshop based on The World Bank implementation manual for four levels of practitioner certification (Solar Home System Maintenance, Solar Home System Installer, Large Stand-Alone System Maintenance, and Large Stand-Alone System Installer). This served to introduce Indian officials and industry to the proposed quality standards framework, and to test the material and presentation in an appropriate setting. PVPS Task III (Stand-alone and Island Systems) also attended to observe proceedings.

Based on the reviews and comments of the attendees, the manual was modified for use in the follow-on implementation workshops in Sri Lanka and South Africa in February 2000, and in China in March 2000. The goals in South Africa were to test the revised materials and to assess the potential for countries to use them without requiring a specially trained instructor.

In the course of the workshop, the participants moved quickly through the material, indicating that they felt that the manual provided sufficient guidance and detail to implement such a program on a national or regional level. In fact the participants decided to move beyond the framework of the

manual and work together to establish a pan-Africa working group to coordinate the development of framework standards for training quality and competence.

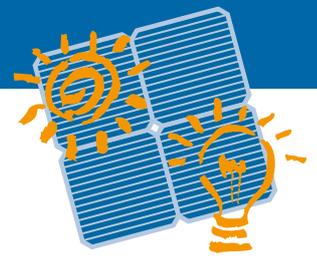
In Sri Lanka, the participants took part in both classroom education and hands-on skills training, as the first phase of becoming certified as PV trainers for solar home systems installation.

At the end of one week, the participants were evaluated through a knowledge examination and a hands-on skills evaluation. Of the 21 participants, 17 received passing marks and will participate in the second phase of the trainer certification program. In evaluating the four who were unsuccessful, it was determined that having the material presented primarily in English, even with a Sinhalese translator available, was insufficient, especially for teaching technology-based subjects. This only emphasises the need for national-level programs to qualify trainers, to avoid having to contract with outside trainers.

For further information Contact Mark Fitzgerald at ISP

Fax: +1 303 470 8239

<http://www.ispq.org>



IN BRIEF

NEW US GRID CONNECTION STANDARD

The new IEEE Recommended Practice for Utility Interface of Photovoltaic Systems, IEEE Std 929-2000 was published in April.

The extensive revision of the previous 929 was in response to the maturation of the PV industry which requires a comprehensive document giving specific recommendations rather than general guidance. The intent of the new standard is to define the technical requirements of PV system interconnection in a manner that can be readily adopted by utilities. It also includes several annexes for tutorial and clarification of test methods and measurements. The standard applies to utility-interconnected PV systems operating in parallel with the utility and utilising static inverters for conversion of direct current (dc) to alternating current (ac).

The document describes specific recommendations for small systems

rated at 10 kW or less. Larger static inverters could also follow the same recommendations.

Contact: John Stevens,
Sandia National Laboratories
Tel: +1 505 844 7717

EUROPEAN PV CONFERENCE Scotland plays host to the world's largest PV meeting

Some 1 300 hundred delegates from nearly 60 countries attended the 16th EPSEC in Glasgow from May 1-5 this year.

As always the technical content of the meeting was high. The main interest surrounded policy and deployment issues, with dramatic news of the impact of the REL on the German PV Programme (see page 3) and a high level of interest in developing country issues, including PV use for small-island states.

Special interest workshops on developing countries (co-organized by World Bank / EU), standards (PV-

GAP) and PV added-value (PVPS-Task I) were well-attended.

Contact: WIP, Munich
Fax: +49 (0)89 720 1291

JAPAN BEGINS SOLAR-GRADE SILICON PRODUCTION

Rapidly expanding global demand, for PV has raised concerns that silicon scrapped by the semiconductor industry will soon be insufficient to satisfy the solar industry's needs.

Since 1996 SOGA, Japan's Solar-grade silicon Technology Research Association, with assistance from the New Energy and Industrial Technology Development Organisation (NEDO), has been working to avert a silicon shortfall. The main technological problems have now been addressed and production has recently commenced at a 60 ton per year pilot manufacturing facility.

Kawasaki Steel Corp., one of the main partners in the project, will start full-scale production in early

2001, with an initial output of 200 t/year. SOGA has been aiming for a SOG-Si production cost of JPY 2 300 per kg. The new solar-specific material is expected to be very competitive with the current scrap silicon price.

Contact Masao Kando, NEDO
Fax: +81 (0)3 5992 6440

PV BEST PRACTICE STORIES

New booklet summarises some of the better projects initiated under the EC THERMIE programme.

The publication, which is intended to motivate others to consider using PV in future infrastructure investments, provides a synopsis of 34 installations across Europe. Projects are categorised in 7 applications sectors: Noise Barriers, Power Stations, Buildings, Transport, Rural Electrification, Islands and Other Uses.

Contact: WIP, Munich
Fax: +49 (0)89 720 1291

NEW ON THE NET

PV PORTAL

Only two clicks away from that missing PV link...

Ekomatic SEC has initiated a new tool which aims to help you find the on-line PV information you are looking for within two clicks. PV Portal provides visitors with a host of links to other PV-related websites, using a simple category locator – e.g. manufacturers, project examples or trade places – to identify relevant sites. The portal is dependent on country-specific 'Partners' located around the world who provide details of URLs that should be listed. Partners for some countries are still being sought. Applications can be made on-line.

<http://www.pvportal.com>

KYOCERA'S SERVICE NET

Kyocera introduces a new on-line technician referral service

PV users can now report system faults to Kyocera's worldwide network of installers via the internet. Within two working days of completion and submission of the on-line service request form, users will be contacted by their nearest available service technician.

Interestingly, the company does not restrict this service only to systems originally purchased through its own network.

The referral service itself is free, though the response may be chargeable depending on the nature of the problem.

<http://www.solarelectricrepair.com>

PV-WEB

The British Photovoltaic Association (PV-UK) has launched its new on-line presence

In addition to standard information on what PV is, applications, news and events, etc., the remodelled website incorporates two useful tools: the first is a searchable directory of UK suppliers of PV products and services; the second is a database containing descriptive listings of all UK PV in buildings projects.

<http://www.pv-uk.org.uk>

COULD YOU MAKE THE DIFFERENCE?

BP poses a 'solar challenge'

BP has initiated an internet forum or 'knowledge network for exchange

of ideas, creative technical openings and inspiration' on solar energy.

The challenge has two focus areas: the first is to develop inexpensive solar panels that can be integrated into residential and commercial buildings, the second is to develop a '21st Century Solarplant' to accommodate the ten-fold increase in production throughput that the company believes will be needed in the next decade if it is to meet the expected growth in demand.

The company is inviting visitors to their website to become part of the solar knowledge network in order to contribute to achieving these two challenges.

http://www.bp.com/earthday/solar_challenge.asp

PVPS NEWS

NEW REPORTS ON BOS COMPONENTS

Batteries and charge controllers are critical elements of most stand-alone PV systems. Two new publications aimed at improving performance and reliability of these components have been produced under PVPS Task III.

The charge controller performs a vital function in the PV system, ensuring that the battery is not subjected to overcharging or overly deep discharging which could prevent them from delivering their rated capacity or even cause premature failure. 'Recommended Practices for Charge Controllers' is a handbook aimed primarily at users, operators and integrators of autonomous PV systems. It contains advice on how to choose, configure and maintain controllers, as well as information on troubleshooting problems and test procedures used to verify satisfactory functioning.

The complementary booklet is the 'Lead-Acid Battery Guide for Stand-Alone Photovoltaic Systems'. Again the report is directed towards the end customers, with a view to improving knowledge of the construction, characteristics and use of such equipment. The guide provides a useful reference for how to install lead-acid batteries and how to maintain them to ensure continued reliable operation.

Both reports will shortly be available for download via the PVPS main website: <http://www.iea-pvps.org>

DEVELOPING COUNTRY SURVEY

The results of the Task III survey of stand-alone applications in developing countries are available from the Task III website.

The survey focused upon past renewable energy programmes: how many there have been; how they

were perceived by officials and consumers; what the local and national government policy issues have been; and how the programmes have affected the technical, financial and institutional infrastructure of the country.

Summary reports presenting the key findings in 21 countries are provided as PDF documents.

<http://www.task3.pvps.iea.org>

TASK-SPECIFIC WEBSITES

Both PVPS Task III (Stand-alone and Island Systems) and Task IX (Technical Cooperation for Market Deployment) now have dedicated internet sites.

The new sites provide additional information on the work being undertaken in each of these areas to that contained on the main PVPS site. In addition, task-specific publications and products can be downloaded directly from these new locations:

Task III: <http://www.task3.pvps.iea.org>

Task IX: <http://www.task9.pvps.iea.org>

Both sites are also accessible via the PVPS main homepage:

<http://www.iea-pvps.org>

ADDED-VALUE

Task I (Information Dissemination) held the second workshop on PV Added-Value in Glasgow in May

The meeting was attended by some 35 delegates aiming to identify and discuss the different added values of grid-connected PV systems for various target groups. Addressing these issues is important for tailoring PV development strategies to influence policy and decision makers.

The results of the Glasgow Workshop and the preceding Sapporo event will be collated and published later in the year.

For further information contact your Task I national representative.

DIARY DATES...

*PV Hybrid Power Systems
Aix en Provence, France
7-8 September 2000*

☛ Bureau de Congres

Fax: +33 (0)442 161 179

<http://www.re.e-technik.uni-kassel.de>

*The City – A Solar Power Station
Bonn, Germany
12-15 September 2000*

☛ Eurosolar

Fax: +49 (0)228 36 12 79

<http://www.eurosolar.org>

*28th IEEE PV Specialists Conf.
Anchorage, Alaska, USA
15-22 September 2000*

☛ John Brenner, NREL

Fax: +1 303 384 6481

<http://ieeepvsc.nrel.gov>

*UPEX 2000 (5th UPVG Conf.)
Baltimore, USA
2-5 October 2000*

☛ Tina Schneider, UPVG

Fax: +1 202 223 5537

<http://www.upvg.org/upvg/upex2000>

*Solar 2000 (38th ANZSES Conf)
Brisbane, Australia
29 November - 1 December 2000*

☛ Conference Secretariat

Fax: +61 (0)7 3844 0909

<http://www.icms.com.au/solar2000>

*IEA Future Building Forum Think Tank
Oslo, Norway
9-11 May 2001*

☛ Helen Shawcross, ESSU

E-mail: exco.support@ecbcs.org

IEA-PVPS NEWSLETTER

NATIONAL NEWSLETTER CONTACTS

AUSTRALIA
Greg Watt
fax 02 9969 1364

AUSTRIA
Gerd Schauer
fax 01 53113 2589

CANADA
Raye Thomas
fax 613 723 5980

DENMARK
Peter Ahm
fax 86 93 36 05

EUROPEAN UNION
Paul Doyle
fax 02 296 0621

FINLAND
Leena Grandell
fax 09 8656 3199

FRANCE
André Claverie
fax 04 93 95 79 87

GERMANY
Peter Sprau
fax 089 720 1291

ISRAEL
Yona Siderer
fax 08 9431118

ITALY
Salvatore Guastella
fax 02 2125 5626

JAPAN
Masao Kando
fax 03 5992 6440

KOREA
Kyung-Hoon Yoon
fax 042 86 03 739

MEXICO
Jaime Agredano Diaz
fax 73 189 854

NETHERLANDS
Astrid de Ruiter
fax 030 231 64 91

NORWAY
Alf Bjørseth
fax 975 71 9013

PORTUGAL
Gina Pedro
fax 11 7939 540

SPAIN
Jesús Garcia Martin
fax 91 57 82 09 4

SWEDEN
Lars Stolt
fax 018 55 50 95

SWITZERLAND
Pius Hüsler
fax 062 834 0323

UNITED KINGDOM
Paul Cowley
fax 0118 973 0820

USA
Charles Linderman
fax 202 508 5225

PV POWER

PV Power is the newsletter of the IEA PVPS Programme. It is prepared by IT Power, UK, under supervision of PVPS Task I.

This newsletter is intended to provide information on the activities of IEA PVPS. It does not necessarily reflect the viewpoints or policies of the IEA, IEA PVPS Member Countries or the participating researchers. Articles may be reproduced without prior permission, provided that the correct reference is given.

Managing Editor: Bernard McNelis
Editor: Paul Cowley
Layout and production: De Boer & van Teylingen, The Hague, Netherlands
Office for correspondence: IT Power Ltd., The Warren, Bramshill Road, Eversley, Hampshire RG27 0PR, UK
E-mail: pvpower@itpower.co.uk

WHEN GRID POWER IS NOT AN OPTION...

CASE STUDY

PROJECT SUMMARY

- Location: Coldstream, Northumberland, UK
- Isolated PV / diesel / battery hybrid
- 2,1 kWp ground-mounted array
- 28 x Astropower AP7105 mono-crystalline modules
- 450 Ah battery at 48 V
- Trace SW4548E 4,5 kVA modified sine-wave inverter
- 11 kVA backup Lister Petter diesel generator
- Typical daily consumption 8 kWh

Contact: Dan Davies, Solar Century
Fax: +44 (0)870 735 8101

When your local electricity company wants to charge GBP 35 000 (over USD 52 000) to lay on mains power you know alternative energy sources have to be investigated.



This was certainly the case for the owner of a refurbished shepherd's house in the idyllic setting of Mindrum Farm in the North of England. A PV-diesel hybrid system now provides an economically and environmentally sound solution to the farm's various power requirements.

The occupier needed a secure power supply with scope for future expansion. The system not only had to meet the demands of typical domestic appliances, but also needed to match occasional surges related to various agricultural activities on the farm. The turnkey package supplied by Solar Century comprises a ground-mounted 2,1 kWp PV array charging a 450 Ah battery via a

charge controller. This feeds power to the main consumer unit via a modified sine-wave inverter with a maximum output of 4,5 kVA. A water cooled diesel generator feeds power to a subsidiary consumer unit to meet occasional and high power loads and for supplementary battery charging.

The diesel set is activated when any of the loads on the subsidiary unit are used, or if the battery is discharged below a pre-set level.

The costs of all the goods and services for the installation of the PV hybrid system amounted to GBP 17 500 (USD 26 000), in other words only half of the cost of connecting to the mains.

RENEWABLE ENERGY PROJECT ANALYSIS SOFTWARE

RETScreen is a pre-feasibility software package which enables users to assess energy production, costs and financial viability of renewable energy projects anywhere in the world.

The package currently provides for evaluation of eight renewable energy technologies through a series of modules which run within the main Excel-based program. The PV-specific module can assist with technical and economic analyses of grid-connected projects, ranging from centralised plants to smaller-scale distributed applications. The

tool can also be used to determine radiation data in the plane of the array based on known horizontal insolation data.

The latest version of the software incorporates a link to NASA's Solar Energy Data Website to allow retrieval of insolation and near-surface air temperature data for any location worldwide. An integrated on-line database of renewable energy products provides information such as product specifications and performance data on equipment that may be used in the project, enabling comparison of alternative components.

The program, which is the work of Canada's CANMET Energy Diversification Research Laboratory (CEDRL) with input from many international renewable energy experts, can be downloaded free of charge from <http://retscreen.gc.ca>

For further information contact CEDRL:
Fax: +1 450 652 5177

